Accelerator Systems Division Highlights Ending October 10, 2004

ASD/JLAB: Cold Linac

Two cavities are qualified for the H-11 string.

Assembly of the H-7 cryomodule is complete. H-8 cryomodule assembly continues on schedule. The H-9 cavity string has been handed over and assembly of the cryomodule has begun.

The H-5 cryomodule has been warmed up and is being prepared for shipment to ORNL.

ASD/BNL: Ring

ASAC talks were presented by Jie Wei, Deepak Raparia, Tom Russo and Joe Tuozzolo.

BNL's Craig Dawson and Joe Meade traveled to OR to assist with testing of Diagnostic electronics during DTL/CCL beam commissioning.

Pioneer Steel has now received four of six master steel plates that are needed for manufacture of the RTBT bend dipole magnet core.

The "jack plate" needed for the primary collimator is in the final stages of manufacture and should be shipped to OR by Nov. 1st.

A container shipment was delivered from BNL to OR earlier this week. It contained:
1) Danfysik system 8000 supply
2) RF electron tube
3) Long injection kicker magnet
4) RF anode cap. module
5) RF rack
6) Long injection kicker stand
7) RF stand

A revised Ring Diagnostics Production Plan (R01) was submitted to the Document Control Center (DCC) at SNS/OR.

Pulse Forming Networks (PFN) - Applied Power Systems is testing the last PFN module (#14).

An internal, pre-production design review was held on the vacuum chamber for the RTBT bend dipole (17D224).

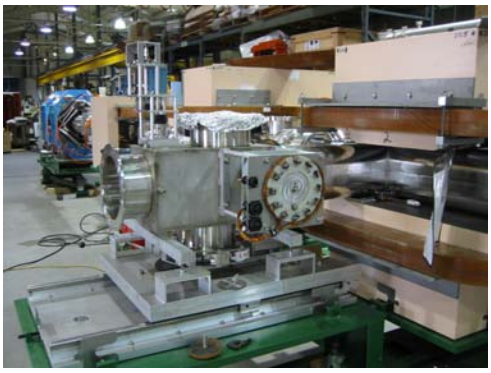
Chicane #1 has been successfully set into final position in the Injection string.

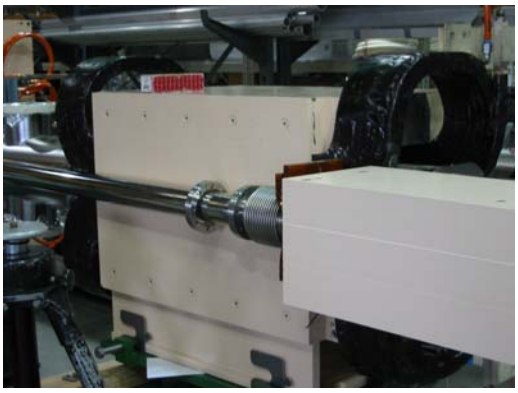
Extraction kicker #7 is being prepared for coating.

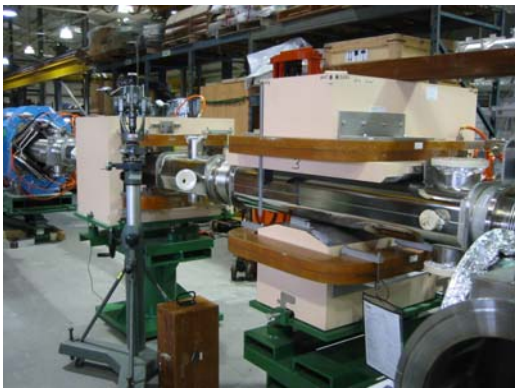
Extraction kicker test: a full power test (35 KV at 60 Hz.) will be conducted next week on a coated extraction magnet in its chamber, under vacuum. Testing has been delayed until next week because of a faulty vacuum pump.

BNL/SNS personnel changes, effective Sept. 30th :

- J. Jackson (retired)
- T. Nepsee – (retired)
- Martin Kesselman (retired)
- R. Van Wormer – (transfer to Physics Dept.)







Controls

Starting Monday evening and for most of the week thereafter the control system ran reliably in support of the ongoing DTL/CCL run. However at the end of the previous week and over the weekend, the system experienced a number of problems of both consequence and interest. These included:

- The failure of a PPS "Chipmunk" on Friday;
- Repeated Communication failures of the RCCS IOC;
- A problem with MPS system which failed "unsafe," and
- The "Not-a-Number Disaster" which resulted in control system "chaos."

We discuss each of these in turn.

Chipmunk Failure: Last Friday, an intermittent fault output from one of the Chipmunks installed for phase 1.2 caused several system trips and prevented operations most of the day. This error occurred with the originally installed Chipmunk and a replacement. Both units were taking out of service. One Chipmunk was sent to the vendor and the other kept at SNS. The problem could not be reproduced in subsequent laboratory testing. The vendor has not yet reported his findings.

RCCS IOC Failure: Over a period of several days, and with a frequency of about once every 8 – 12 hours, the DTL RCCS IOC lost contact with the rest of the control system. This showed up as a loss of heartbeat. Although many communication statistics are routinely archived, no obvious precursor could be identified. Interlocks correctly shut off all magnet power supplies and the LLRF systems. After many desperate attempts to improve the situation, including changing the IOC and the communication switch, the RCCS IOC was split in two, and the "Beckhoff" software, which monitors the DTL drift tube thermocouples, was moved to a separate IOC. The system has performed well since, and a faulty software driver for the Beckhoff bus is currently suspected. A test stand has been set up to further analyze this problem.

MPS Failure: Late in the week, a problem in the MPS fiber hardware was discovered when the beam apparently did not shut off after a DC power supply tripped. The fiber transmitters were configured for ECL instead of RS422 inputs. This caused excessive noise to be picked up when there was no carrier present. This noise made it appear that MPS did not trip as an apparent carrier would come and go. The issue was resolved with the correct configuration of the hardware, and all affected MPS chassis were modified.

"Not-a-Number:" An elog entry describing the control system as being in unprecedented "chaos" ushered in a frantic day of analysis followed by an ongoing and extensive discussion throughout the worldwide EPICS community. It was discovered that under certain conditions the Java-based "**S**ave **Co**mpare and **Re**store" (SCORE) program could (and apparently did) send out to EPICS setpoints the IEEE standard code for "not-a-number (NaN)." EPICS does not recognize this code. On Sunday evening at 10:27pm – as observed in the archive – all or most of the SCORE setpoints were set in EPICS to NaN, resulting in anomalous, unpredictable and in some cases potentially dangerous (to equipment) behavior. It took several hours to identify the problem and then carefully and systematically reset the setpoints to reasonable and safe values. The SCORE application was quickly corrected, and

can no longer send NaN to EPICS. Our experience was reported to the worldwide EPICS community, where a discussion now rages about the correct place and method to filter NaN. Indeed some believe it should not be filtered at all by the common parts of EPICS – NaN is, after all, a legitimate IEEE-defined code and one can imagine an application wanting to use it.) Solutions are under discussion in the EPICS core group at APS. In the meanwhile, a simple test at the driver level now protects SNS power supplies from the NaN scourge. Incidentally, it is possible that occasional occurrences of NaN, which have been found to be scattered throughout earlier SCORE files, may account for infrequent and irreproducible but annoying incidents when an IOC reboot caused some device setpoint to change value unaccountably.

Not everything of interest this week had to do with problems. There was progress on many fronts:

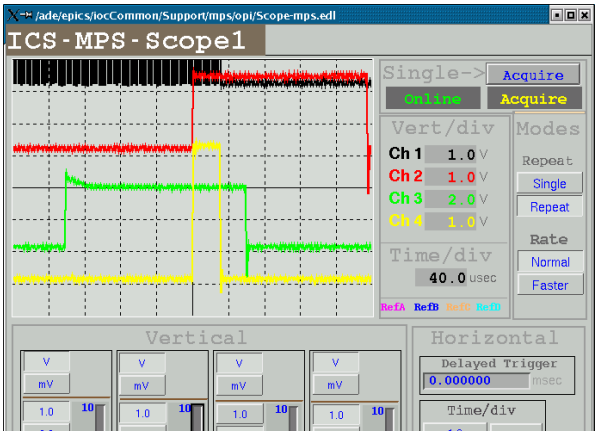
For the Cryogenic Control system, a contract for the fabrication of the cables/connectors that connect the beam line interface to various ports on the High Beta cryomodules was awarded. The first set of cables is expected to arrive in about 3 weeks. Power to the tuner rack for MB cryomodules 5 – 8 was energized and checkout of the rack was started. Problems with the tuner motor control for MB 1 – 4 were diagnosed and corrected. Checkout of the screens and PLC controls for the 2 K cold box continued.

Work continued on the LLRF system, including algorithms for automatic recovery from loss of RF power and a Matlab script for basic beam feed-forward experiments. "HPRF OK" was added to the HPM interlocks, so that "Modulator Down" will now trip the MPS via software and check the modulator voltage before re-starting LLRF after a trip. This change is scheduled to be installed during the next maintenance period.

Work continued on development of a LEBT Chopper Control Prototype. One interface board has been received, assembled and tested; the second board is currently being routed. The FPGA design is underway, and has been tested with the first interface board.

The order for the remaining ten Chipmunks (for the target building) was placed at the end of September. HEBT PLC programs have been generated for the PPS and the HEBT PLC remote I/O rack is almost ready for installation in the HEBT service building. SROs have been generated for PPS cabling and conduit in the SCL; title II design for HEBT, Ring, and RTBT PPS is continuing and PPS backbone fiber has been installed from the CLO to the Front End, HEBT, Ring, and RTBT. Plans are to complete termination and testing by mid December.

Work is also proceeding on several fronts for the Target PPS. Work packages are under development for the installation of PPS cable and conduit. Design is proceeding on the control panels and field devices. Some of this equipment will be fabricated in house and the rest by DCS in Alcoa using an existing task order contract.
Tests have been initiated to determine the speed of MPS response to Beam Loss Monitor (BLM) trips. Tests with CCL_BLM104 and CCL_FC104 inserted show the BLM does trip the beam within the pulse. However, because the RFQ responds too slowly, the beam would cut off in ~60 usec with a 15 ma peak beam. The scope trace below shows the beam (yellow trace) dropping with the MPS carrier (black trace). The correlation log below shows that in each case MPS (FPAR_CCL) is dropped 6usecs after the BLM detects loss (BLM104).



Installation

Craft Snapshot 10/5/04

ASD productive craft workers	**63.0**
Foremen (Pd by 15% OH)	5.0
AMSI management (Pd directly)	3.0
TOTAL AMSI WORKERS	71.0
Less WBS 1.9, 1.2 etc	**10.0**
Less absent	**2.0**
TOTAL PD BY ASD/ORNL DB WPs	**51.0**

Accelerator Physics

Previously we reported on investigations into the best way to lower the elevation of the end of the RTBT down to the elevation of the target. We have now settled on the approach of changing the elevations of quadrupole magnets QV15 and QV17 to provide the needed steering. This method has the advantage of providing a well-steered beam to the target with all the corrector magnets set to zero. To achieve a 5 mm elevation change, QV15 should be 1 mm low, and QV17 should be 2 mm low.

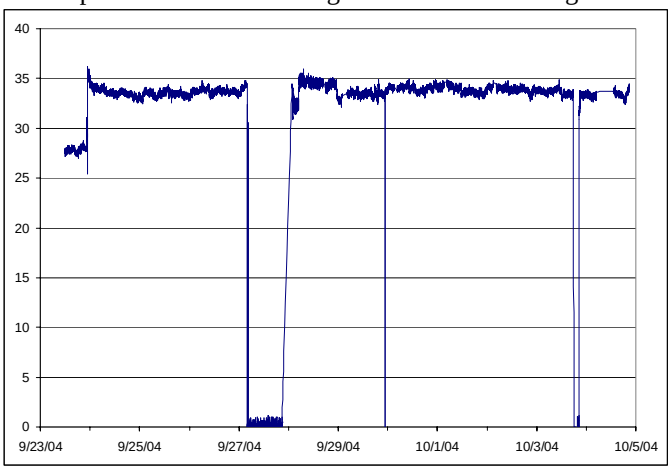
Work continues on the radiation model calculations for the end of the RTBT. We are now updating the tunnel geometry and building models of the various magnets.

A draft tech note has been written to detail the effects of using a ring stripper foil with a trapezoidal geometry and mounted at an angle of 30 degrees relative to the beam direction (this is the planned foil type and orientation). This geometry and orientation leads to an increase in beam loss of about 20% compared to a simple planar stripper foil.

Operations

Ion Source

The ion source on the hot spare stand is currently producing 32 mA. The run started 14 days ago with a current output of about 34 mA. Encountering only few trips, a trip during the weekend resulted in almost one day of downtime. This amazing success was achieved with Roberts new condition procedure that leaves the cesium collar cold to preserve the Al and Zr getter in the Cs cartridges.



One of us presented “Ghost Signal Busting in Allison Emittance Scanners” at the 16th International Workshop on ECR Ion Sources, which was held at LBNL. The presentation was received with high interest because many ion source labs use this type of emittance scanners since it was introduced over 20 years ago. It appears to be first time that the problem of beam dumping in electrical sweep scanners has been addressed and eliminated. The ghost signals can lead to a significant error in emittance evaluation, especially for the rms emittance. A report is in preparation.

The day after the workshop was used to visit with Rod Keller, John Staples, and Alex Ratti. Rod Keller's setup with his hybrid H- source looks impressive. First extraction of an H- beam is expected shortly. After establishing a high H- output, the emittance needs to be determined, which means that we will have to return the Allison emittance scanner to LBNL in the near future.

Survey and Alignment

The prototype warm section, located between medium beta cryomodule slot MB03 and MB04, was rough aligned. This rough alignment was vital in determining clearances between various components since the 8q35 warm section magnets require repositioning (different from the physics lattice) to make room for the laser/optics box.

The ceiling mounted laser/optics box was aligned in the same location.

S&A has begun a realignment campaign of the HEBT dipoles along with the initial alignment of the QH14 quadrupole rafts.

S&A performed an as-built of all the ring half cells. This as-built was to determine if major movement of any of the half cells would require the beam pipes to be disconnected. This disconnecting of the beam pipes would break the vacuum system already in place.

The monthly RTBT floor monitoring campaign was completed this week. During the last month, the floor at the RTBT interface has settled an additional 2.3 mm. The low point is now 6.97 inches below design elevation. The RTBT backfill operation has now been completed for 78 days.

Also, we are beginning to monitor settlement of the compressor located in the compressor building.

Seven RTBT stands were set for elevation and are ready for grouting.

Beam line 11 core vessel insert was surveyed. This completes the survey on all of the installed core vessel inserts. This leaves five core vessel inserts to be installed.

Several meetings were attended to discuss the issue of alignment of the guides in the shutter inserts and on the instrument floor.

We are continuing to strengthen our targeting of the beam lines throughout the target building.

Two 8q35's have been fiducialized this week.

Mechanical

Water Systems Installation

- Installation of the DI piping to SCL-ME7 continued.
- Installation of the CLO Magnet Measurement Lab cooling piping was completed
- Installation of the CLO Power Supply Lab cooling piping was completed.
- Installation of the CLO Vacuum Lab compressed air and water piping was started.
- Installation of the FEB communications room AC unit piping was completed.
- The 2 HEBT Collimator Closed Loop Cooling skids were received and moved into position.
- Installation continued on the RING SB power supply cooling system upgrade

Ring Systems Installation

- The last 2 HEBT 21Q40 magnets were installed completing the HEBT arc installation.
- The RING arc Qtr-Cells and RTBT magnet stands were formed and grouted.
- The Injection Long Kicker Magnet was received and staged in the RF straight section...
- The Linac Dump Window and remote clamp/seal was successfully installed and leak tested.

- The Linac dump flight tube is currently being pumped down
- The DC and diagnostic cable installation in the HEBT tunnel continued on the recently installed 21Q40 magnets.
- Three additional RTBT 21Q40 magnet stands were placed.
- An installation/integration meeting was held with XFD on the Injection Dump.
- The 32 - DURATEK shield blocks for the HEBT truck entrance were received and staged.

Magnet Task

Electrical Group

HPRF

LLRF

Cryo Group

Beam Diagnostics

BPM:
BPMs continue to run reliably. Craig Deibele performed a set of time-of-flight measurements using a scope. Sasha Aleksandrov will analyze the data. Craig Dawson and Joe Mead visited and set up ring BPM electronics to measure BPM SCL00 signals. This electronics package is directly receiving the event link and RTDL, and is controllable over the network from BNL.

BCM:
All BCMs are working, including SCL00. They are available on the Channel 13 web page. Absolute calibration has drifted since the beginning of the run. This will be resolved when the built in calibration is implemented. BNL delivered and a new timing/calibration board and provided updated software. Cary Long and Joe Mead worked together to demonstrate all of the basic functionality. We are now ready to perform additional testing in the mezzanine lab.

D-Box:
The emittance scanner has been tested with beam. Preamplifiers and bias circuitry has been modified based on initial tests. The first results look encouraging, but additional tests and careful analysis is still required.

BLM:
All ion chambers and neutron detectors continue to work well. The noise due to coupling from the analog power supply appears to have been resolved by Viktor. MPS testing is ongoing. Andrei continues to log data and test the thermal neutron detectors.

Misc.
All 82 Diagnostics IOCs appear to have weathered the software/network problem of last week without incident. The log files were reviewed and no abnormal events were observed. Status of software configuration control was reviewed: Since the beginning of this commissioning run, one bug fix has been deployed to the timing NADs; all other IOC software has been running unchanged.